VASCULAR FLORA OF MORSE CLAY PRAIRIES IN NORTHWESTERN LOUISIANA

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ABSTRACT

We describe the floristics, soils, small-scale species richness, and phytogeographic affinities of Morse Clay calcareous prairies in northwestern Louisiana. Four 0.1 ha plots had 159 species and averaged 85 species, eight 0.001 ha plots averaged 27 species, and eight 0.0001 ha plots averaged 19.5 species. The most diverse families were Asteraceae (40 species), Fabaceae (23 species), and Poaceae (17 species). The soils are predominantly alkaline high-calcium silty clay loams. The North American distribution of Morse Clay prairie species is eastern and central. Whether Morse Clay prairies should be considered a distinct community type will depend on further research on isolated prairies in nearby Texas, Arkansas, and Louisiana, but at the present time they do not appear to be distinct from at least some of the calcareous prairies in the region.

RESUMEN

Se describe la florística, suelos, riqueza de especies a pequeña escala, y afinidades fitogeográficas de las praderas calcáreas de Morse Clay en el noroeste de Louisiana. Cuatro parcelas 0.1 ha tuvieron 159 especies y una media de 85 especies, ocho parcelas de 0.001 ha tuvieron una media de 27 especies, y ocho parcelas de 0.0001 ha tuvieron una media de 19.5 especies. Las familias con más diversidad fueron Asteraceae (40 especies), Fabaceae (23 especies), y Poaceae (17 especies). Los suelos son predominantemente margas limosas alcalinas con alto contenido en calcio. La distribución norteamericana de las especies de pradera de los Morse Clay es oriental y central. Si las praderas Morse Clay deben, o no, considerarse un tipo de comunidad diferente dependerá de investigaciones posteriores en praderas asiladas en las cercanas Texas, Arkansas, y Louisiana, pero actualmente no parecen ser diferentes de al menos algunas praderas calcáreas de la región.

INTRODUCTION

While prairies are one of the most endangered plant communities in North America, they are one of the best studied (Sims & Risser 2000; Diggs et al. 2006). Thousands of books and papers have been written on the floristics, management, and restoration of prairies. Louisiana prairies were documented in the eighteenth and nineteenth centuries by land surveyors, cartographers, and explorers; however, botanists did not begin to study them until the 1930s (Brown 1997; MacRoberts et al. 1997, 2003; MacRoberts & MacRoberts 2004 and references therein). Southeastern prairies, except for the prairie belt of Alabama and Mississippi, have been woefully neglected in the literature (Leidolf & McDaniel 1998; Peacock & Schauwecker 2003; Barone 2005; Barone & Hill 2007). However, such isolated prairies were extensive in pre-European times, and there still exist many small, relatively natural prairies in the pineywoods region of Texas, Arkansas, Louisiana, and Mississippi (Jordan 1973; Brown et al. 2002; Foti et al. 2003; Zollner et al. 2003; MacRoberts & MacRoberts 2004).

Included in this group are the "Morse Clay" prairies of northwestern Louisiana and southwestern Arkansas (McInnis 1997; Lester et al. 2005; Arkansas Natural Heritage Commission pers. comm.). These are small, grassy openings that occur on reddish, fine textured, alkaline and calcareous clays and silt loams (Chaffin et al. 1959). While the fire frequency was not different from surrounding woodland, these prairies, like so many others, are maintained as openings in the oak-pine woodlands by soil-dependent variations in grass biomass, resulting differences in fire intensity, and extreme soil properties (Diggs & Schulze 2003; Lester et al. 2005; Diggs et al. 2006). Herbivory by large mammals may also play a role.

The purpose of this paper is to describe the floristics of Morse Clay prairies in northwestern Louisiana and to compare them with prairies elsewhere in the southeast.

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THE SETTING

Morse Clay prairies and soils occur on Pleistocene intermediate terraces in northwestern and central Louisiana and southwestern Arkansas. Prairies typically exist as small openings on side-slopes and flats in shortleaf pine/oak-hickory forests (Figs. 1 and 2) (Lester et al. 2005). Presettlement extent of Morse Clay prairies is estimated to have been between 800 and 4,000 ha, with 5 to10 percent thought to remain (Louisiana Natural Heritage Program 1993). A recent status survey of Louisiana Morse Clay prairies revealed 11 occurrences totaling a mere 60 ha, and nearly half of that area was in poor condition (MacRoberts & MacRoberts 2007b).

The best known examples of Morse Clay prairies are found on the 9,000 ha Barksdale Air Force Base and 14,000 ha Bodcau Wildlife Management Area in Bossier Parish, Louisiana. Barksdale AFB was purchased in the late 1930s. The western side is maintained as an air force base; the eastern side is undeveloped and supports undulating oak-pine woodlands with occasional prairie openings. Prior to its establishment as an air base, large scale timber harvesting had eliminated all virgin timber. When the Federal Government acquired the land, it was generally open fields and cropland (McInnis 1997). Current management of the eastern part is focused on wildlife, oil and gas exploitation, timber harvesting, and recreation. Consequently, few areas remain in natural or semi-natural condition. All of the prairie area has been subject to disturbance, notably fire suppression, food plot development with plowing, and part of it was at one time a bombing range with large craters. Teague and Wendt (1994) and McInnis (1997) give an overview of the entire area.

Bodcau WMA, owned by the U.S. Army Corps of Engineers and leased by the Louisiana Department of Wildlife and Fisheries, has similar habitat to that of Barksdale AFB with similar areas of Morse Clay prairie (Lester et al. 2005). At Bodcau by the mid-1950s, prairies were cotton farmed and over-grazed by livestock (John Haygood, pers. comm.). Some of the prairie area in Bodcau WMA is protected in registered natural areas, but much of the area that was historically prairie is now plowed land managed for food plots. All areas where Morse Clay prairie occurs have had ground disturbance in the past.

METHODS

In order to have comparable samples, we modified the plot design of Peet et al. (1998) used widely in the southeast. We established four study plots in four prairies away from prairie edges (Fig. 3). Three plots were established in closely adjacent prairies on Barksdale AFB, and one plot was established on a single prairie on Bodcau WMA 32 km to the northeast. Each plot measured 20 m × 50 m or 31.6 m × 31.6 m (0.1 ha). Within each 0.1 ha plot were two nested 3.16 m × 3.16 m (0.001 ha) plots. Each of these in turn had a 1 m × 1 m (0.0001 ha) nested plot within it. Thus, there were four 0.1 ha plots, eight 0.001 ha plots, and eight 0.0001 ha plots. We surveyed each plot for total species. All species in the plots were recorded every month over a year between 2006 and 2008 (except in mid-winter). A specimen of all species collected is deposited at Louisiana State University Herbarium (LSU). Nomenclature follows Kartesz and Meacham (2005) and *Flora of North America* (1993–2006).

Using our list of species found in the four Morse Clay prairies and data from *Flora of North America* (1993–2006) and NatureServe (2008), we plotted the North American distribution of species by state, region, or province to determine the geographic pattern of Morse Clay prairie species (Fig. 4).

We collected soil samples from the upper 20 cm within the prairies, in the woodlands above the prairies, and in the woodlands below them at about 3 meters from the prairie edge. These we had analyzed for pH, various elements, and soil texture at Louisiana State University Soil Testing and Plant Analysis Laboratory.

We made brief floristic surveys of other Morse Clay prairies in Caddo and Bossier parishes (MacRoberts & MacRoberts 2007b).

RESULTS/DISCUSSION

The four study plots had 159 species: North Pond had 105, Lower Green Tree had 85, Bomb Crater had 75, and Nemastylis had 76 (Table 1). Asteraceae, Fabaceae, and Poaceae dominated with 40, 23, and 17 species, respectively. The plot richness (Table 2) is about average for open plant communities (e.g., bogs and xeric sandylands) throughout the West Gulf Coastal Plain with about 20 species per 0.0001 ha, 27 species per 0.001 ha, and 85 species per 0.1 ha) (MacRoberts et al. 2007). Table 3 gives Sorenson's Index of Similarity among the four prairies. This level of similarity indicates that they are the same community. Soil texture in the prairies was either silty clay loam or silty clay (Table 4). Soil textures of upslope woodlands ranged from silty clay loam to very fine sandy loam. The range of pH value in the prairies was 6.8 to 8.3, n = 7. By contrast, pH values ranged from 4.6 to 5.6, n = 4 in the woods above the prairie, and 5.2 to 7.4, n = 3 in the woods below prairies. Calcium concentration was substantially higher in prairie soils versus soils collected from adjacent woodlands. Potassium concentration also seems to generally be higher in prairie soils.

We found five state rare species in the prairies. *Carex meadii* (S2S3) is found in several west Louisiana parishes where it occurs in calcareous and coastal prairies and in sandstone glades. It occurred in or near all of the study plots. *Coreopsis palmata* Nutt. (S1), found only in Bossier and Claiborne parishes, occurred only in Bomb Crater Prairie, and only at its upper edge. At Bomb Crater, *Coreopsis palmata* appeared to be associated mainly with upland woodlands. *Houstonia purpurea* var. *calycosa* (S2) occurs in Bossier, Caldwell, Grant, LaSalle, and Winn parishes in calcareous prairies. This species was common in North Pond Prairie but was not found at the other Morse Clay prairies. *Nemastylis geminiflora* (S2S3) is found in several West Gulf Coastal Plain parishes. It was found in the Lower Green Tree and Nemastylis prairie plots and in the prairies adjacent to both the North Pond and the Bomb Crater prairie plots. *Koeleria macrantha* Ledeb. (S1) (Reid 5546 LSU) occurred in Bomb Crater Prairie but just outside of the plot. This is one of the only two extant populations in Louisiana, the other being in a calcareous prairie in Winn Parish. Further information on rare species and the explanation of "S" ranks can be found in Louisiana Natural Heritage Program (2007).

Isolated prairies occur across the West Gulf Coastal Plain and eastward (Peacock & Schauwecker 2003; MacRoberts & MacRoberts 2004). While few prairies have been the subject of comprehensive floristic studies, enough have been done to provide quantitative comparisons. Brown et al. (2002) studied Windham Prairie in Polk County, Texas, 250 km southwest of Bossier Parish. An Index of Similarity (Sorenson's) between Windham Prairie and our Morse Clay prairies is 37. Leidolf and McDaniel (1998) studied Sixteen Section Prairie in Oktibbeha County, Mississippi, about 450 km east of Bossier Parish. An Index of Similarity between it and our Morse Clay prairies is also 37. Barone and Hill (2007) studied several blackland prairies in Alabama and Mississippi about 500 km east of our study sites. An Index of Similarity between those sites and the Morse Clay prairies is 31. Contrasted with these figures, the Keiffer prairies in Winn Parish, Louisiana (Smith et al. 1989; MacRoberts & MacRoberts 1996), 125 km southeast of the Morse Clay prairies, have an Index of Similarity of 51 with the Morse Clay prairies. This figure is especially interesting since North Pond Prairie on the Bodcau WMA, only 32 km northeast of the three Barksdale AFB prairies, differed from them as much as did the Keiffer prairies (Table 3). Unfortunately, there are no complete floristic inventories of the blackland and Morse Clay prairies of southwestern Arkansas. However, Foti (1989) provides a preliminary list of species in ten of the less disturbed blackland prairies approximately 120 km north of our Morse Clay prairies. An Index of Similarity between those sites and our Morse Clay prairies is 44 a difference that indicates the importance of additional study of southwestern Arkansas prairies, notably since such species as *Carex microdonta* Torr. & Hook. and *Spiranthes magnicamporum* C. Sheviak have recently been found in them (Theo Witsell pers. comm.).

Morse clay soils proved similar to soils of other calcareous prairies in Louisiana, Arkansas, and Texas which are alkaline and are high in calcium. Of the properties tested for all prairies, phosphorus and potassium were the same; only magnesium was higher (MacRoberts & MacRoberts 1996, 2004).

Judging habitat condition is difficult, notably when there is no known "natural" habitat for comparison. Unfortunately, this is the case for Morse Clay prairies, none of which are pristine; all have been subject to various unnatural disturbances, notably clearing, grazing, plowing, fire suppression, and bombing. One can only attempt to reconstruct what these prairies were like by studying those surviving remnants that most closely resemble our best estimate of the structure and composition of presettlement plant communities.

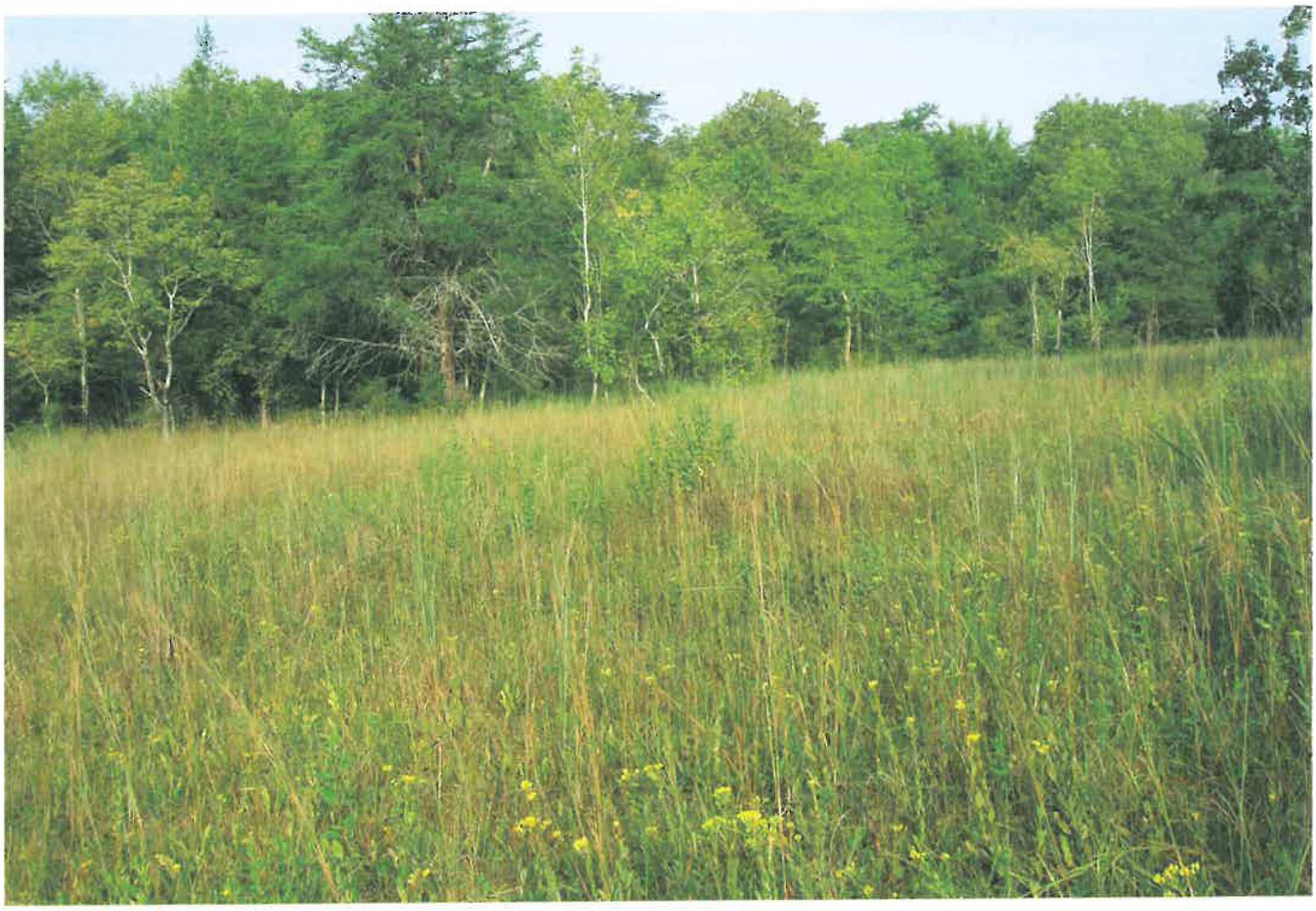

FIG. 1. Morse Clay Prairie.

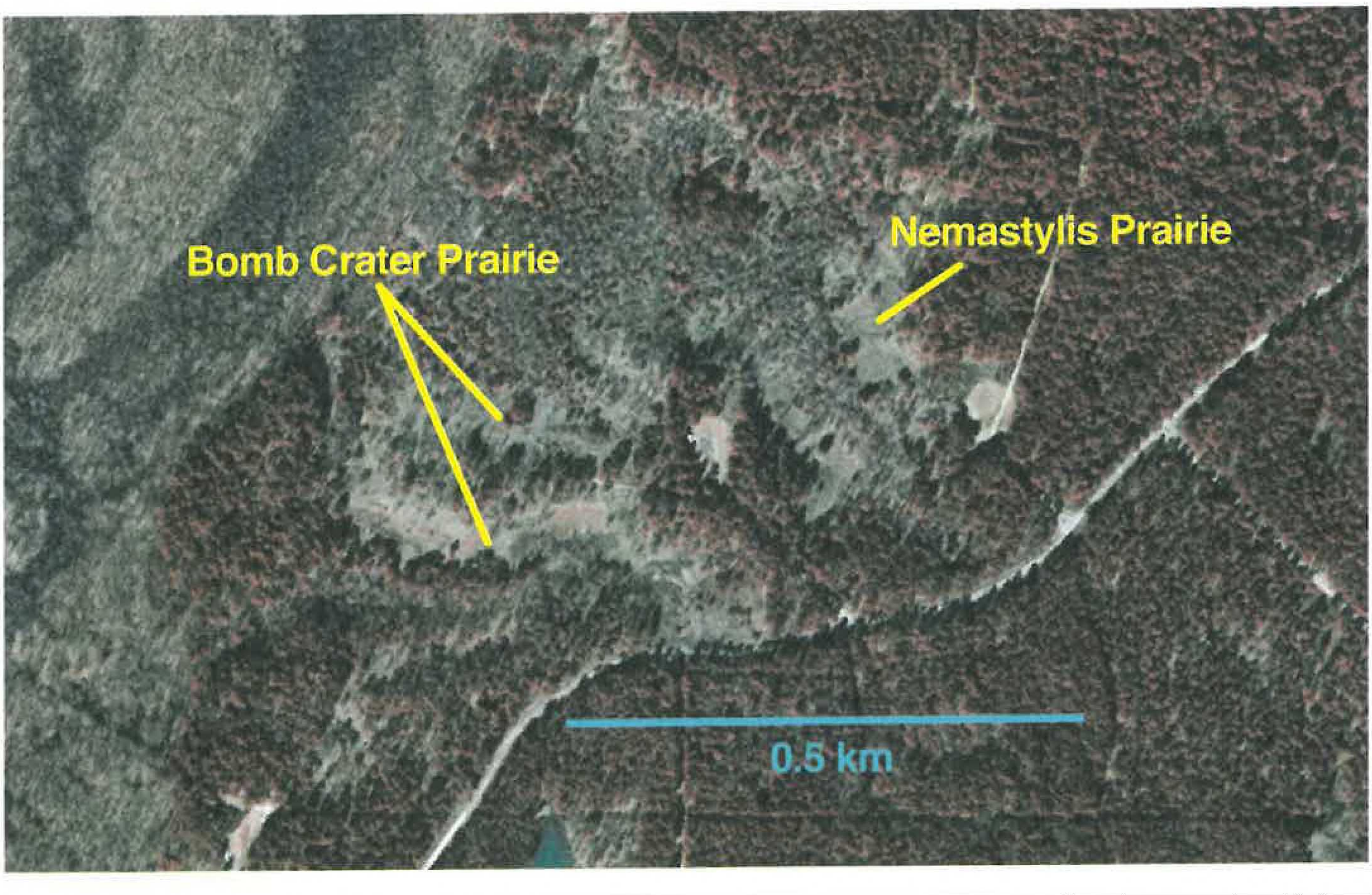

FIG. 2. Aerial photograph of Morse Clay Prairie.

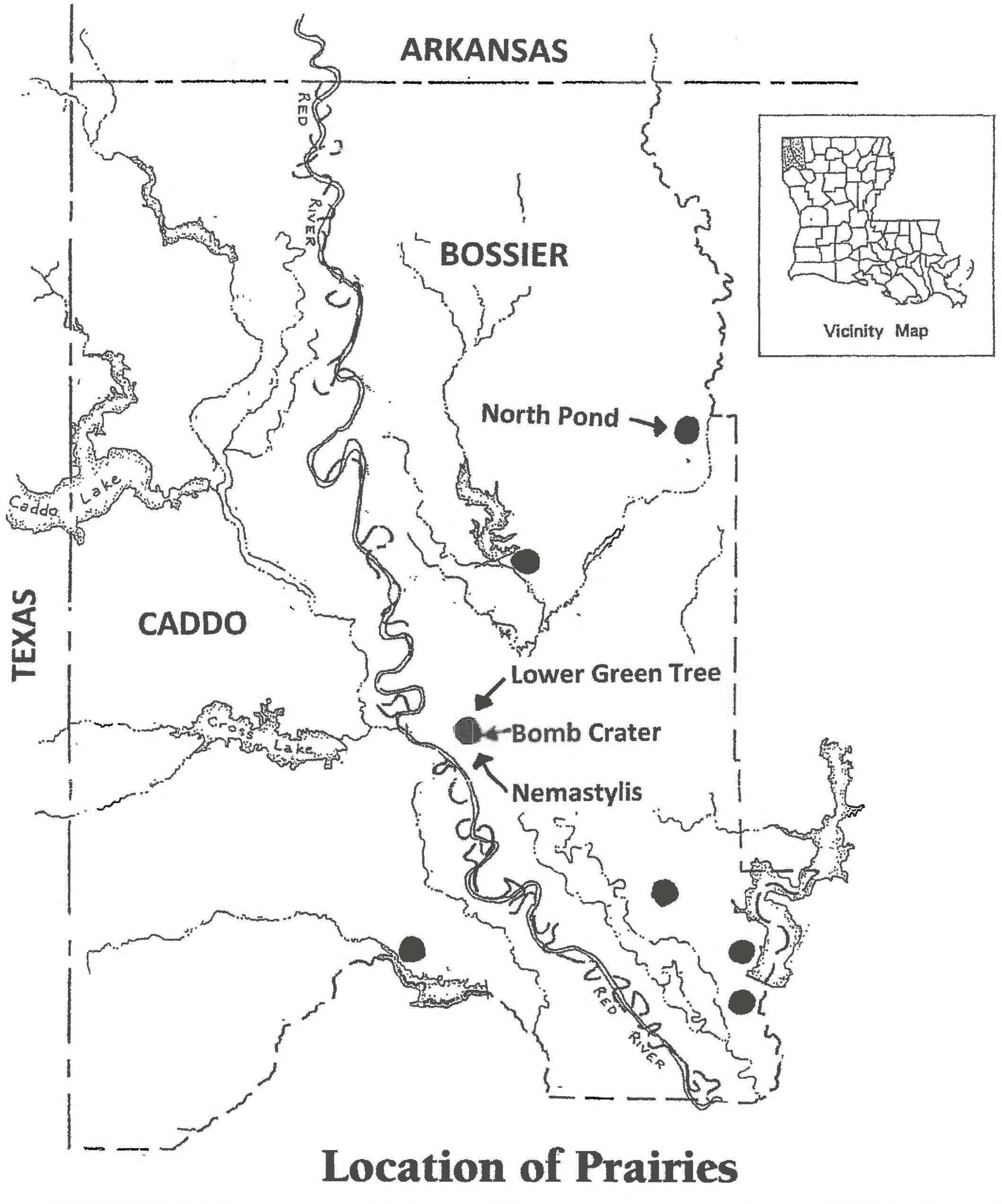

Fig. 3. Location of Morse Clay prairies in Caddo and Bossier parishes, Louisiana. Unlabeled dots are locations of other Morse Clay prairies that were briefly surveyed. Labeled dots are the location of the prairies that were intensively studied.

While it is clear that the best remnants of this prairie type occur on Barksdale AFB and Bodcau WMA (McInnis 1997), these sites can scarcely be described as "relatively undisturbed." Thus, our best estimate becomes largely subjective based on our experience with other prairies in the West Gulf Coastal Plain (including other Morse Clay prairies surveyed as part of this study but not reported here [MacRoberts & MacRoberts 2007b]). Assessing such characteristics as native biotic diversity and presence/absence of exotics (McInnis 1997), we determined that the four Morse Clay prairies we studied had 10 (6%) exotics, which indicates

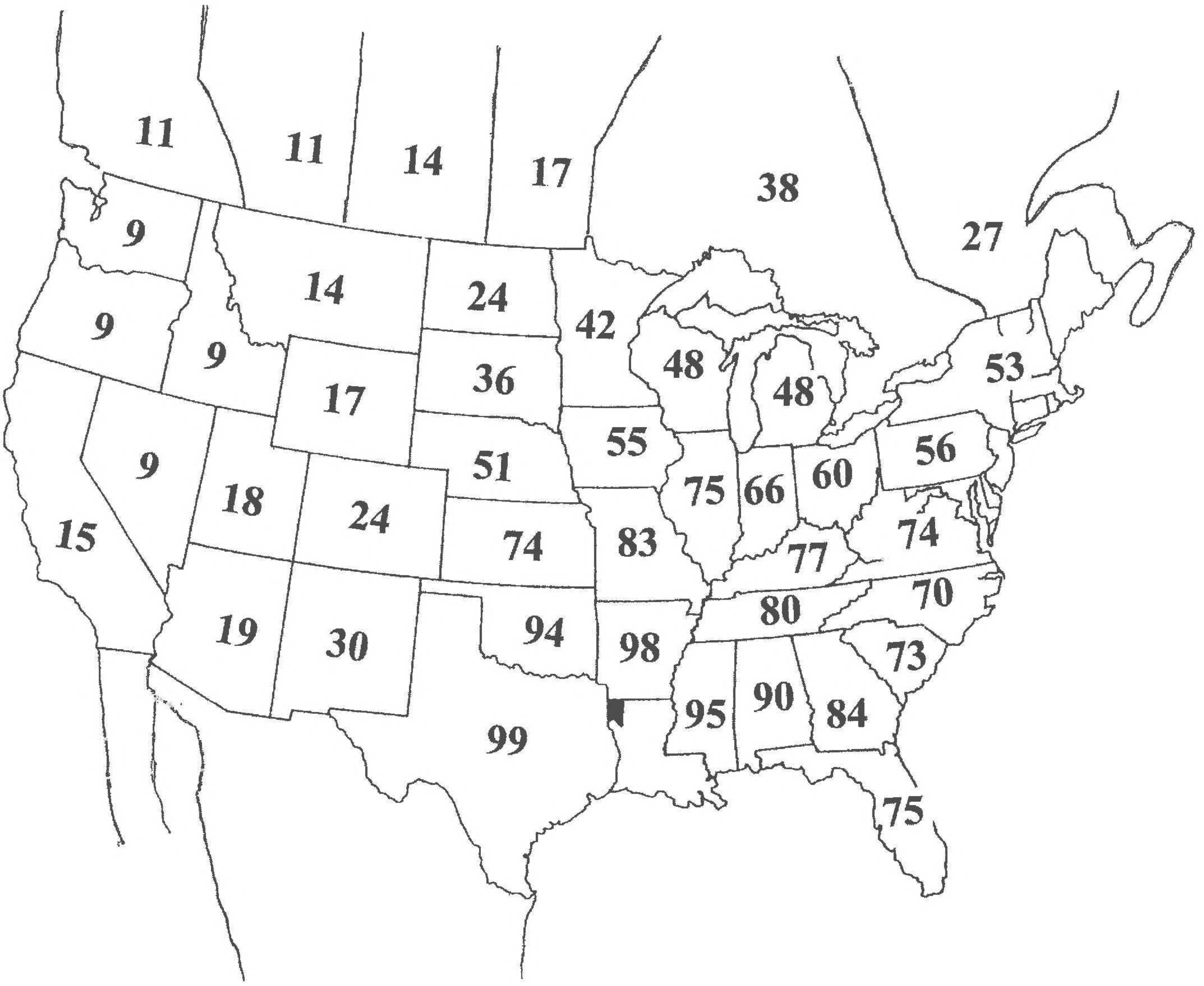

Fig. 4. North American distribution of native Morse Clay prairie species. Numbers are percent of total that occur in state, province, or region. Bossier and Caddo parishes, the location of Morse Clay prairies, are shown in northwestern Louisiana.

little disturbance (MacRoberts et al. 2008). The Barksdale AFB and Bodcau WMA prairies are therefore important because they present a standard by which the quality of other Morse Clay prairies may be evaluated, but care should be exercised in making general conclusions from these few scattered remnants, all of which have undergone a long history of anthropogenic disturbance.

The North American geographic distribution of Morse Clay Prairie species is decidedly eastern. However, a comparison of their distribution with that of Caddo Parish flora as a whole (MacRoberts & MacRoberts 2007a) shows that their affinities are slightly more central and western than are those of Caddo Parish (Caddo Parish is just west of Bossier Parish and also has Morse Clay prairies, see Fig. 3). This might be expected since there are many habitats in Caddo Parish that are exclusively eastern (e.g., swamps); whereas prairies generally have a central and western component.

ACKNOWLEDGMENTS

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TABLE 1. Vascular flora of four Morse clay prairies (**NP** = North Pond Prairie, **LGT** = Lower Green Tree Prairie, **BC** = Bomb Crater Prairie, and **N** = Nemastylis Prairie. * = exotic species).

Acanthaceae
Ruellia humilis Nutt., NP, LGT, BC, N, MM 7780, 7698, 7515, 7484
Agavaceae
Manfreda virginica (L.) Rose, NP, LGT, N, MM 7477
Yucca louisianensis Trel., LGT, MM 7857
Anacardiaceae
Toxicodendron radicans (L.) Kuntze, NP, LGT, BC (no specimen collected)
Apiaceae
Eryngium yuccifolium Michx., BC, N, MM 7540
Trepocarpus aethusae Nutt. ex DC., NP, LGT, MM 7781
Aquifoliaceae
Ilex decidua Walt., NP, LGT, BC, MM 7512
Araceae
Sabal minor (Jacq.) Pers., NP, MM 7504
Asclepiadaceae
Asclepias verticillata L., NP, LGT, BC, N, MM 7786, 7560, 7961
Asclepias viridis Walt., NP, MM 7689, 7562
Asteraceae
Ambrosia artemisiifolia L., LGT, N (no specimen collected)
Ambrosia bidentata Michx., NP, MM 7523
Ambrosia psilostachya DC., NP, MM 7522
Ambrosia trifida L., LGT, MM 7556
Arnoglossum plantagineum Raf., NP, LGT, BC, N, MM 7690, 7713
Baccharis halimifolia L., NP, LGT, BC, N, MM 7509, 7531
Boltonia diffusa Ell., N, MM 7965
Cirsium horridulum Michx., NP, LGT, BC, MM 7685, 7712
Coreopsis lanceolata L., NP, LGT, BC, N, MM 7783, 7688, 7718
Coreposis palmata Nutt., BC, MM 7793, 7845
Echinacea pallida (Nutt.) Nutt., NP, LGT, MM 7691
Echinacea sanguinea Nutt., BC, MM 7791, 7789
Erigeron strigosus Muhl. ex Willd., NP, LGT, BC, N, MM 7703, 7707, 7479, 7716
Erigeron tenuis Torr. & A. Gray, N, MM 7630
Eupatorium serotinum Michx., BC, N, MM 7536
Eurybia hemispherica Alexander) Nesom, BC, N, MM 7530
Gaillardia aestivalis (Walter) H. Rock, LGT, MM 7480
Helianthus hirsutus Raf., LGT, BC, N, MM 7794, 7846, 7858
Heterotheca subaxillaris (Lam.) Britt. & Rusby, LGT, MM 7558
Iva annua L., NP, LGT, BC, N, 7557, 7840
Liatris aspera Michx., NP, LGT, BC, N, MM 7500, 7553, 7485, 8054
Liatris squarrosa (L.) Michx., BC, MM 7454
Marshallia caespitosa Nutt. ex DC., LGT, N, MM 7715
Parthenium integrifolium L., NP, LGT, BC, N, MM 7460, 7853
Rudbeckia hirta L., LGT, N, MM 7859
Silphium integrifolium Michx., NP, MM 7517
Silphium laciniatum L., BC, MM 7459, 7847
Solidago canadensis L., LGT, MM 7552
Solidago nitida Torr. & A. Gray, NP, BC, N, MM 7498
Solidago rigida L., LGT, BC, N, MM 7557, 7849, 7841
Symphyotrichum drummondii (Lindl.) Nesom, LGT, MM 7472
Symphyotrichum laevis (L.) A. & D. Löve, LGT, BC, N, MM 7478, 7572, 7838, 8057, 8115
Symphyotrichum lateriflorum (L.) Löve & Löve, NP, LGT, MM 7579
Symphyotrichum ontarione (Weigand) Nesom, LGT, MM 7575, 7576
Symphyotrichum oolentangiensis (Riddell) Nesom, LGT, BC, N, MM 7573, 7966
Symphyotrichum patens (Ait.) Nesom, NP, LGT, BC, N, MM 7499, 7482, 7546, 8116
Symphyotrichum pilosum (Willd.) Nesom, NP, LGT, BC, N, MM 7554
Symphyotrichum praealtum (Poir.) Nesom, NP, N, MM 7570
Symphyotrichum pratense (Raf.) Nesom, BC, N, 7962, 8114
Vernonia texana (A. Gray) Small, NP, LGT, MM 7492
Bignoniaceae
Campsis radicans (L.) Seem. ex Bureau, LGT, N, MM 7837
Boraginaceae
Onosmodium bejariense DC. ex A. DC., NP, MM 7519
Campanulaceae
Lobelia appendiculata A.DC., NP (no specimen collected)
Caprifoliaceae
**Lonicera japonica* Thumb., BC, MM 7535
Symphoricarpus orbiculatus Moench., BC, MM 7527
Viburnum rufidulum Raf., NP, BC, MM 7508
Convolvulaceae
Dichondra carolensis Michx., LGT, MM 7722
Cornaceae
Cornus drummondii C.A. Mey., BC, MM 7532
Cupressaceae
Juniperus virginiana L., LGT, MM 7580
Cuscutaceae
Cuscuta pentagona Engelm., N, MM 7839, 8110
Cyperaceae
Carex abscondita Mack., NP, MM 7702
Carex cherokeensis Schwein., NP, LGT, BC, N, MM 7636, 7624
Carex meadii Dewey, NP, LGT, N, MM 7632, 7622, 8136
Fimbristylis puberula (Michx.) Vahl, BC, MM 7708
Scleria ciliata Michx., NP, MM 7779b
Scleria oligantha Michx., NP, MM 7779a
Ebenaceae
Diospyros virginiana L., NP, LGT, BC, N, MM 7503, 7534
Euphorbiaceae
Chamaesyce nutans (Lag.) Small, LGT, MM 7559b, 7582
Croton monanthogynus Michx., NP, LGT, N, MM 7520, 7469, 7964
Euphorbia corollata L., LGT (no specimen collected)
Tragia urticifolia Michx., NP, LGT, BC, N, MM 7488, 7709
Fabaceae
Acacia angustissima (Mill.) Kuntze, NP, LGT, BC, N, MM 7470
Astragalus distortus Torr. & A. Gray, NP, LGT, N, MM 7628, 7571, 7625, 7471
Baptisia bracteata Muhl. ex Elliott, NP, LGT, BC, N, MM 7629, 7618

Centrosema virginianum (L.) Benth., LGT, MM 7854
Cercis canadensis L., BC, MM 7526
Chamaecrista fasciculata (Michx.) Greene, NP, MM 7494
Dalea candida Willd., NP, BC, N, MM 7777, 7792
Dalea purpurea Vent., NP, LGT, BC, N, MM 7456
Desmanthes illinoensis (Michx.) MacM. ex B.L. Robins & Fern., LGT, BC, N, MM 7855
Galactia volubilis (L.) Britt., NP, LGT, BC, N, MM 7851
Gleditsia triacanthos L., NP (no specimen collected)
**Lespedeza cuneata* (Dum. Cours.) G. Don, NP, BC, MM 7493
**Medicago lupulina* L., NP, MM 7785
Mimosa nuttallii (DC.) B.L. Turner, N, MM 8183
Mimosa strigillosa Torr. & A. Gray, NP, LGT, BC, N, MM 7496
Neptunia lutea (Leavenw.) Benth., NP, LGT, BC, N, MM 7516, 7481
**Trifolium dubium* Sibth., NP, MM 7693

Fagaceae
Quercus stellata Wangenh., NP, BC, MM 7843

Gentianaceae
**Centaurium pulchellum* (Sw.) Druce, LGT, MM 7852
Sabatia campestris Nutt., NP, N, MM 7782

Iridaceae
Nemastylis geminiflora Nutt., LGT, N, MM 7619
Sisyrinchium albidum Raf., LGT, BC, MM 7620
Sisyrinchium langloisii Greene, NP, MM 7695, 7633

Lamiaceae
**Prunella vulgaris* L., NP, LGT, BC, N, MM 7687, 7717
Pycnanthemum tenuifolium Schrad., BC, MM 7529
Salvia azurea Michx. ex Lam., LGT, BC, N, MM 7550, 7863, 8113
Salvia lyrata L., NP, LGT, BC, N, MM 7635, 7623

Liliaceae
Allium canadense L., NP, BC, N, MM 7699, 7706
Nothoscordum bivalve (L.) Britt., NP, LGT, MM 7637, 7626

Lythraceae
Lythrum alatum Pursh, BC, LGT, NP, N, MM 7856

Moraceae
Maclura pomifera (Raf.) Schenid., NP, MM 7501

Oleaceae
Fraxinus pennsylvanica Marsh, NP, LGT, BC, N, MM 7510, 7533

Onagraceae
Oenothera speciosa Nutt., NP, N, MM 7701

Orchidaceae
Spiranthes laciniata (Small) Ames, NP, MM 7788

Oxalidaceae
Oxalis corniculata L., NP, MM 7638, 7700

Pinaceae
Pinus echinata Mill., NP, MM 7514

Poaceae
Andropogon gerardii Vitman, NP, LGT, BC, N, MM 7545, 7537, 7466
Andropogon glomeratus (Walt.) B.S.P., NP, LGT, BC, N, MM 7538
Andropogon virginicus L., NP, LGT, MM 7567
Aristida oligantha Michx., NP, MM 7568
**Botriochloa ischaemum* L., NP, MM 7583
Bothriochloa longipaniculata (Gould) Allred & Gould, LGT, MM 7861, 7487
Dichanthelium aciculare (Desv. ex Poir.) Gould & Clark, LGT, BC, NP, N, MM 7719, 7710, 7694
Elymus virginicus L., NP, LGT, BC, MM 7506, 7473
Eragrostis lugens Nees, N, MM 8056, 8112, 7963
Eragrostis spectabilis (Pursh) Steud., NP, LGT, N, MM 7542
Panicum anceps Michx., NP, BC, MM 7864
Paspalum floridanum Michx., NP, LGT, N, MM 7544
**Paspalum dilatatum* Poir., LGT, MM 7581, 7586
Paspalum laeve Michx., NP, MM 7867
Schizachyrium scoparium (Michx.) Nash, NP, LGT, BC, N, MM 7564, 7541
Setaria parviflora (Poir.) Kerguelen, LGT, BC, N, MM 7474, 7548
**Setaria pumila* (Poir.) Roem. & Schult., NP, MM 7565
Sorghastrum nutans (L.) Nash, LGT, BC, N, MM 7539, 8117, 8055
Sphenopholis obtusata (Michx.) Scribn., NP, LGT, BC, N, MM 7714, 7711
Sporobolus asper (Beauv.) Kunth, NP (no specimen collected)
Sporobolus compositus (Poir.) Merr., NP, LGT, MM 7566, 7574, 7543
Tridens strictus (Nutt.) Nash, NP, MM 7569
Tripsicum dactyloides (L.) L., NP, MM 7865

Polemoniaceae
Phlox pilosa L., NP, MM 7696

Ranunculaceae
Amenone berlandieri Pritz., NP, MM 7631
Delphinium carolinianum Walt., NP, MM 7784

Rhamnaceae
Berchemia scandens (Hill) K. Koch, NP, LGT, BC, N, MM 7513

Rosaceae
Crataegus brachyacantha Sarg. & Engelm., NP, MM 7502, 7495
Crataegus marshallii Egglest., NP (no specimen collected)
Crataegus spathulata Michx., NP, MM 7505
Rosa carolina L., NP, MM 7490, 7778
Rosa setigera Michx., BC, N, MM 7790, 7850
Rubus trivialis Michx., NP, LGT, N, MM 7634

Rubiaceae
Hedyotis nigricans (Lam.) Fosberg, LGT, BC, N, MM 7547, 7476
Houstonia micrantha (Skinner) Terrell, NP (no specimen collected)
Houstonia purpurea L. var. *calycosa* A. Gray, NP, MM 7497, 7697

Sapotaceae
Sideroxylon lanuginosum Michx., NP, LGT, BC, N, MM 7511, 7483

Scrophulariaceae
Agalinis heterophylla (Nutt.) Small, NP, LGT, MM 7525, 7555
Agalinis tenuifolia (Vahl) Shinners, NP, N, MM 7563, 8111
Aureolaria grandiflora (Benth.) Pennell, BC, MM 7467
Pedicularis canadensis L., BC (no specimens collected)
Penstemon laxiflorus Pennell, NP, BC, N, (no specimens collected)
Penstemon tubaeflorus Nutt., N, MM 8182, 7686, 7705

Smilaceae
Smilax bona-nox L., NP, LGT, BC, N, MM 7518, 7475
Ulmaceae
Ulmus alata Michx., NP, LGT, MM 7507
Ulmus crassifolia Nutt., LGT, BC, N, MM 7528
Valerianaceae
Valerianella radiata (L.) Dufr., NP, MM 7692
Verbenaceae
Glandularia canadensis (L.) Nutt., NP, LGT, BC, N, MM 7627, 7621
Lippia nodiflora (L.) Michx., NP, MM 7787, 7491
**Verbena brasiliensis* Velloso, NP, MM 7521
Verbena halei Small, NP, N, MM 7866
Vitaceae
Ampelopsis arborea (L.) Koehne, LGT, BC, N, MM 7860

TABLE 2. Species richness in Morse Clay Prairies.

Plot and plot size (ha)	No. of	Average species (range)
North Pond Prairie		
0.0001	2	21(20–22)
0.001	2	30.5(28–33)
0.1	1	105
Lower Green Tree Prairie		
0.0001	2	22(21–23)
0.001	2	28.5(28–29)
0.1	1	85
Bomb Crater Prairie		
0.0001	2	11.5(5–18)
0.001	2	18(17–19)
0.1	1	75
Nemastylis Prairie		
0.0001	2	23.5(21–26)
0.001	2	30.5(25–36)
0.1	1	76
Total		
0.0001	8	19.5(5–26)
0.001	8	26.9(17–36)
0.1	4	85.3(75–105)

TABLE 3. Index of Similarity (Sorenson's) among four Morse Clay prairies (**NP** = North Pond Prairie, **LGT** = Lower Green Tree Prairie, **BC** = Bomb Crater Prairie, and **N** = Nemastylis Prairie). Formula is (2C/(A + B)) × 100 where C = number of species in common between two samples, A = total species in sample A, and B = total species in sample B.

	NP	LGT	BC
NP	-	-	-
LGT	56	-	-
BC	49	61	-
N	53	66	72

Table 4. Soils data for Morse Clay Prairies in northwest Louisiana.

		Calcium	Copper	Magnesium	Phosphorous	Potassium	Sodium	Sulfur	Zinc	Soil
Sample	pH	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	Texture
LGT-Woods above prairie	4.8	417.3	1.4	408.2	7.7	101.4	26.4	7.6	1.4	Silt loam
LGT- Upper part of prairie	8.1	6352.8	1.7	763.8	4.2	272.6	13.6	8.2	1.1	Silty clay
LGT- Lower part of prairie	8.2	6682.5	7.7	742.9	3.7	314.1	7.7	7.9	22.2	Silty clay loam
LGT-Woods below prairie	5.2	1685.6	1.1	832.1	7.4	187.1	10.2	12.8	1.4	Silty clay loam
BC-Woods above prairie	4.6	163.1	0.6	143.4	3.1	46.7	7.2	8.7	0.6	Silt loam
BC-Upper part of prairie	7.2	4363.1	4.7	857.0	6.2	269.9	12.4	7.5	1.6	Silty clay
BC-Lower part of prairie	8.1	7854.0	1.9	1010.1	4.0	365.3	6.4	10.3	1.7	Silty clay
BC-Woods below prairie	7.2	4674.7	1.6	1097.9	4.1	365.8	11.8	9.4	0.9	Silty clay
NP-Woods above prairie	4.8	540.1	0.5	539.0	7.7	103.6	16.6	6.3	3.3	Silty clay loam
NP-Upper part of prairie	6.8	2917.8	1.7	1301.0	3.4	293.4	11.7	7.4	0.8	Silty clay loam
NP- Lower part of prairie	8.3	8514.4	1.6	959.8	2.4	340.2	8.2	9.3	0.6	Silty clay loam
N – Woods above prairie	5.6	344.5	0.2	74.0	5.9	33.3	9.9	10.7	0.5	Very fine sandy loam
N – In center of prairie	7.3	5830.2	1.8	734.9	8.6	321.4	418.3	69.6	2.5	Silty clay loam
N – Woods below prairie	7.4	6118.1	2.8	590.9	11.3	332.5	14.3	20.4	2.7	Silty clay loam

us prairies and share with us his knowledge of the plant life of the area. John Haygood, formerly a Louisiana Department of Wildlife and Fisheries biologist, provided information on the condition of Bodcau prairies in the 1950s. Bob O'Kennon, Botanical Research Institute of Texas, Guy Nesom, and Charles Allen aided with plant identification. Theo Witsell, Arkansas Natural Heritage Commission, provided information on the Arkansas Morse Clay prairies. Latimore Smith, Dennis Bell, and an anonymous reviewer made useful suggestions that improved the manuscript.

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